

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P13487/OLL	<b>FOR FURTHER ACTION</b>	
See Form PCT/IPEA/416		
International application No. PCT/EP2004/001503	International filing date (day/month/year) 18.02.2004	Priority date (day/month/year) 18.03.2003
International Patent Classification (IPC) or national classification and IPC H01Q1/24, H01Q21/24, H01Q9/04, H01Q1/38		
Applicant SONY ERICSSON MOBILE COMMUNICATIONS AB ET AL.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
  - a.  *(sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:*
    - sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - b.  *(sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).*

4. This report contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

Date of submission of the demand 03.12.2004	Date of completion of this report 24.08.2005
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Moumen, A Telephone No. +31 70 340-4411



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

**JC20 Rec'd PCT/PTO 1 C SEP 2004**  
International application No.  
PCT/EP2004/001503

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
    - international search (under Rules 12.3 and 23.1(b))
    - publication of the international application (under Rule 12.4)
    - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):
  - a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
  - The amendments have resulted in the cancellation of:
    - the description, pages
    - the claims, Nos.
    - the drawings, sheets/figs
    - the sequence listing (*specify*):
    - any table(s) related to sequence listing (*specify*):
  - This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
    - the description, pages
    - the claims, Nos.
    - the drawings, sheets/figs
    - the sequence listing (*specify*):
    - any table(s) related to sequence listing (*specify*):

**Description, Pages**

1-13 as originally filed

**Claims, Numbers**

1-18 received on 01.12.2004 with letter of 29.11.2004

**Drawings, Sheets**

1/4-4/4 as originally filed

a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

- The amendments have resulted in the cancellation of:
  - the description, pages
  - the claims, Nos.
  - the drawings, sheets/figs
  - the sequence listing (*specify*):
  - any table(s) related to sequence listing (*specify*):
- This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
  - the description, pages
  - the claims, Nos.
  - the drawings, sheets/figs
  - the sequence listing (*specify*):
  - any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2004/001503

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-18
	No: Claims	
Inventive step (IS)	Yes: Claims	1-18
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-18
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

PCT/EP2004/001503

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

Reference is made to the following document:

D1: US-B1-6 369 762 (YANAGISAWA WASUKE ET AL) 9 April 2002 (2002-04-09)

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document):

a diversity radio antenna (Fig. 1), comprising a ground substrate (1), first and second elongated antenna elements (3a,3b), each extending between respective first and second opposing ends in a plane parallel to and spaced from said ground substrate (1), and an excitation electrode (2) interposed between said respective first ends, each antenna element (3a,3b) having one grounding point connectable to the ground substrate (1).

The subject-matter of claim 1 differs from this known radio antenna in that

the first antenna element has a first ground connector switch means selectively connecting or disconnecting its grounding point to ground, and the second antenna element has a second ground connector switch means selectively connecting or disconnecting its grounding point to ground, wherein said ground connector switch means are devised to selectively connect one or both of said antenna elements to said ground substrate for controlling radiation beam pattern and polarisation diversity of the antenna.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as how to provide a compact antenna having beam pattern and polarisation diversity while maintaining a fixed radio frequency feeding pass.

The solution to this problem proposed in claim 1 is not known from, nor suggested by the available prior art. Hence, the subject-matter of claim 1 is considered as involving an

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

PCT/EP2004/001503

inventive step (Article 33(3) PCT).

Claims 2-18 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**Although claim 1 satisfies the requirements of Article 33, amendments are however required in order to satisfy the requirements of Article 6 (see Re Item VIII).**

**Re Item VIII**

**Certain observations on the international application**

Each of the embodiments described in the description and drawings contains the following essential features in combination:

- the antenna comprises an L-shaped dielectric member having two substantially perpendicular legs extending parallel to the ground substrate.
- the dielectric member has an upper surface facing away from the ground substrate and a lower surface arranged in direct contact with the ground substrate,
- two antenna elements are arranged on the upper surface of the dielectric member, a first antenna element extends along a first leg of the dielectric member and the second antenna element extends along a second leg of the dielectric member and is separated from the first antenna element by a gap,
- an excitation electrode is arranged in said gap at the intersection of the legs of the dielectric member and provides capacitive coupling to said antenna elements so that each antenna element is adapted for transmission and reception of a linearly-polarised wave,
- by changing the state of the switches circular, vertical or horizontal polarisation could be selected and diversity is achieved.

**since claim 1 does not contain these features, it considered that claim 1 is not supported by the description as required by Article 6 PCT, as its scope is broader than justified by the description and drawings.**

JC20 Rec'd PCT/PTO 16 SEP 2009

## CLAIMS

1. A diversity radio antenna, comprising a ground substrate (1), first and second elongated antenna elements (2,3), each extending between respective first (5,6) and second opposing ends (7,8) in a plane parallel to and spaced from said ground substrate, and an excitation electrode (4) interposed between said respective first ends, each antenna element having one grounding point connectable to the ground substrate, **characterised in** that the first antenna element (2) has a first ground connector switch means (9) selectively connecting or disconnecting its grounding point to ground, and the second antenna element (3) has a second ground connector switch means (10) selectively connecting or disconnecting its grounding point to ground, wherein said ground connector switch means (9,10) are devised to selectively connect one or both of said antenna elements to said ground substrate for controlling radiation beam pattern and polarisation diversity of the antenna.
- 15 2. The diversity radio antenna as recited in claim 1, **characterised in** that said grounding points are devised at said respective second ends of the antenna elements.
3. The diversity radio antenna as recited in claim 1, **characterised in** that said 20 antenna elements extend substantially perpendicular to each other in said plane.
4. The diversity radio antenna as recited in claim 1, **characterised in** a MEMS switch controls the switching action of each of said ground connector switch means
- 25 5. The diversity radio antenna as recited in claim 1, **characterised in** that said excitation electrode is capacitively coupled to said respective first ends of said antenna elements.
- 30 6. The diversity radio antenna as recited in claim 1, **characterised in** that said ground connector switch means are devised to connect said first and second antenna

elements to ground, for adapting the antenna to a circularly-polarised radio wave.

7. The diversity radio antenna as recited in claim 1, **characterised in** that said ground connector switch means are devised to connect one of said first and second antenna elements to ground, and disconnect the other of said first and second antenna elements from ground, for adapting the antenna to a linearly-polarised radio wave.
8. The diversity radio antenna as recited in claim 1, **characterised in** that said ground connector switch means are devised to selectively connect said first and second antenna elements to ground for adapting the antenna to a circularly-polarised radio wave, or disconnect one of said first and second antenna elements from ground for adapting the antenna to a linearly-polarised radio wave.
- 15 9. The diversity radio antenna as recited in claim 1, **characterised in** that said ground connector switch means are devised to selectively connect said ground substrate to said antenna elements over a predetermined impedance.
10. The diversity radio antenna as recited in claim 1, **characterised in** that said ground connector switch means are devised to selectively connect said ground substrate to said antenna elements over a predetermined inductive impedance.
11. The diversity radio antenna as recited in claim 1, **characterised in** that each of said first and second antenna elements have an electrical length of one quarter of a predetermined radio frequency wavelength.
12. The diversity radio antenna as recited in claim 1, **characterised in** that a dielectric member is interposed between said plane and said ground substrate.

13. The diversity radio antenna as recited in claim 12, **characterised in** that said dielectric member is made of a ceramic material.
14. The diversity radio antenna as recited in claim 12, **characterised in** that said 5 antenna elements and said excitation electrode are provided on a first surface of the dielectric member, whereas said ground substrate is formed adjacent to a second surface of said dielectric member, opposite and parallel to said first surface.
15. The diversity radio antenna as recited in claim 14, **characterised in** that said 10 antenna elements and said excitation electrode are formed by a coat of an electrically conductive material provided on said first surface, whereas a first and a second spacing between said excitation electrode and said first and second antenna element, respectively, are formed by etching of said coat.
16. The diversity radio antenna as recited in claim 14, **characterised in** that a radio 15 frequency feed conductor extends from said excitation electrode along a side surface of said dielectric member, to a feed pad at said second surface.
17. The diversity radio antenna as recited in claim 1, **characterised in** that said 20 ground substrate is formed as a material layer in a printed circuit board.
18. A radio communication terminal (30), **characterised by** comprising a diversity radio antenna according to any of the previous claims.